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ABSTRACT

This monograph provides policy makers and administrators with an overview of distance education principles, technology, and application as they exist today. Section I discusses elements of a distance education process. General headings are personnel, hardware, and software. Section II considers the historical development of distance education and its current application. Section III addresses advantages, such as flexibility in relation to students and faculty, built-in quality control, easy evaluation and revision, separation of student and teacher, and lower cost per student, as well as disadvantages (resistance, lack of student interaction, teacher certification, turf questions, issues of cultural diversity). Section IV discusses the potential value of distance education for vocational education. Examples are provided that illustrate the variety of possibilities for distance education. These include skill updating of power station control technicians in Queensland, Australia; teaching of employability skills in Colorado Springs, Colorado; and offering of electives in Oregon public schools through a program originating in San Antonio, Texas. The following sections (V through VII) discuss costs and benefits, teacher training needs, and evaluations of current distance education programs. Section VIII provides brief descriptions of four model programs. A summary addresses getting started and distance education for vocational education. A list of definitions is appended. Ninety-nine endnotes are provided. (YLB)

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Distance Education and Its Applications for Vocational Education

by
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SYNOPSIS

Imagine that it is a cold snowy day in northern Indiana. A vocational education teacher is preparing to teach a class in robotic technology. There is no one else in the classroom except three studio technicians. Across town there is a classroom with twelve students. Thirty-five miles to the east there is a classroom with twenty-five students. One hundred fifty miles to the south is a classroom with sixteen students and sixty miles to the southeast, in a modern automobile manufacturing plant, is a classroom with thirty-two students. Each classroom is equipped with a large TV monitor and each desk is equipped with a microphone. The students can see and hear the teacher, and they can communicate with the teacher and other students. The teacher has a console equipped with a monitor for each class location. Technology of the future? Yes, but it is also technology that is already in existence and would be more easily adapted to this situation.

> "The delivery systems that schools and institutions develop will be a key to success. Current trends toward experimentation with delivery systems--from offering courses via telecommunications to contracted, on-site instruction in the workplace--are positive; Nevertheless, vocational education institutions will need to further expand scheduling, geographic access, program entry and exit points, and special services. Institutions will need to deliver services where the student wants them, rather than expecting students to always attend classes at a centralized facility or at traditional times."[1]

One viable solution to delivering educational programs in the vocational community is through the use of distance education. Distance education is the first viable alternative to centralized public education since the teacher-oriented model was incorporated into western culture more than a century ago. Once believed to be an impersonal means of imparting information, distance education technology has changed and is now an effective and accepted means in an age when high-tech is no longer feared by the vast majority of those entering the workforce.

Transporting information instead of people, providing flexibility for study and providing the very best of learning technologies through distance education, are themselves motivational factors. From a practical sense, it seems that distance education is often the most viable alternative. Transporting an expensive industrial robot from place to place to teach a course is not practical. Purchasing a robot for every location is not practical. One centrally located, extensively equipped laboratory may be used in conjunction with several remote learning laboratories equipped with less extensive equipment. The same can be said when kitchens, automotive shops, machine shops and various agricultural settings are used to teach courses. This is not to imply that hands-on experiences in those settings are eliminated completely. Occasional travel to those locations may be necessary rather than daily, weekly, or bi-weekly travel.

DISTANCE EDUCATION AND ITS APPLICATIONS FOR VOCATIONAL EDUCATION

A VES Monograph

INTRODUCTION

The purpose of this monograph is to provide information about distance education(*) to assist the Indiana Commission on Vocational and Technical Education (ICVTE) in carrying out its objective to plan, develop policy for and coordinate the delivery of vocational and technical education services that will help the citizens of Indiana actively participate in economic development efforts.

The ICVTE has been charged with conducting long-range planning with regular assessments of needs. The ultimate plan is to provide program recommendations that can contribute to vocational and technical education in Indiana. The degree to which the Indiana vocational education system is providing the knowledge, skills and attitudes that employers require is a major factor that must be continuously assessed. That assessment must include not only the currency of curriculum and the proficiency levels of the teachers, but it should also address the medium by which instruction is conveyed to the learner.

Note: The definitions of some key terms used in this monograph are given in the Appendix. These terms are indicated in the text with an asterisk (*) at their first occurrence.

Distance education may be a viable means of providing instruction to the vocational and technical education community in the 1990s. Although there have been many scholarly studies and a vast amount of experience gained in distance education, there is still much to be learned and determined. This paper is intended to provide policy makers and administrators with an overview of distance education principles, technology, and application as they exist today. A good understanding of these should assist in solving vocational and technical education challenges in the future.

What is Distance Education? The most basic characteristic of distance education is that the teacher and the student, though generally separated by space and time, are able to carry out the educational process using some type of two-way communication.[2] An example of extreme separation would be a correspondence student, in a remote region of northern Canada, who only receives mail once a week and whose course materials take a month to be sent in, corrected, and returned. A much less extreme example is a student who attends a weekly night class, at a local center, where the instruction is transmitted from a studio eighty miles away, via interactive television.(*)

In fact a more recent definition reflects the wider use of technology that is current in distance education:

> [Distance Education is] the application of telecommunications and electronic devices which enable students and learners to receive instruction that originates from some distant location. Typically, the learner is given the capacity to interact with the instructor or program directly, and given the opportunity to meet the instructor on a periodic basis.[3]

There is a sense in which distance education in its modern forms has only become practical in an increasingly technological age. Even the early correspondence courses at the turn of the century were made practical by the increased efficiency of mail service which was tied to the development of the railroad. By logical extension, state-of-the art communications technology greatly enhances the possibilities for modern distance education.[4]

Interaction between the student and the supporting organization is an important feature of distance education, and distinguishes it from independent study. One expert in the field calls the interaction "organized two-way communication."[5] The most common medium for this interchange over the years has been the written and printed word. With the rapid development of communications technology, however, telephones, computers, satellite links(*), and fiber optics(*) are increasingly common.

The following examples of distance education enhance the preceding definitions. In Kenya, distance education programs have been used successfully in rural areas for those who have not been able to attend formal secondary schools. One program there used a combination of correspondence material and field trips to local farms to prepare students both academically and practically in an agriculture course.[6]

The Department of Forest Resources and the Minnesota Extension service, University of Minnesota, are planning a statewide program to train their staff in the use of microcomputers. This training need is of increasing importance as more and more agencies are equipped with microcomputers linked in a network. A pilot program was carried out in which word processing and networking operations where taught to eight individuals across the state from a central computer. Two-way phone communication with the instructor was also used. Despite some technical difficulties related to recently installed hardware(*), the trainees were very positive about the training. They felt they had learned as much as they would have in a face-to-face training session.[7]

An example from industry is seen in a distance training program used by IBM for its sales representatives. Instruction, using a video/audio signal, is broadcast from one of three transmission sites to as many as nine receiving sites. Each trainee has a control panel which can be used to signal the instructor that they have a question. The panel can also be used by the trainee to answer multiple choice questions which the instructor broadcasts, and from which information on the trainee's responses is received. Thus the instructor is able to make immediate instructional decisions based on trainee's progress.[8]

Growing interest in distance education at the federal level is seen in the Star School Program(*). Congress has approved funds to develop distance education technology and materials to help small and remote schools in the improvement of math, science, and foreign language teaching.[9]

I. ELEMENTS OF A DISTANCE EDUCATION PROCESS

The basic elements which exist in the traditional educational setting also exist in distance education. There are obviously teachers, students and course materials. But there are also important differences which distinguish the distance model from the traditional. The various elements are presented under the general headings: Personnel, Hardware, Software(*) and other elements.

PERSONNEL

The Teacher in Distance Education. The teacher's role in distance education can vary across a wide range of possibilities. If the instruction originates in a studio and is transmitted via television to remote classrooms, the teaching role may have many similarities to the traditional.

If a student is studying mostly at home using self-instructional material, Computer-Assisted Instruction(*) (CAI), or satellite link, contact with the "teacher" is both less frequent and of a different nature than in the traditional model. In such a distance setting, teachers "act more as facilitators and less as omniscient lecturers, more as course designers and less as the sole learning resource."[10] Another apt analogy is to compare the teacher to a coach who guides and encourages the student's active pursuit of knowledge.[11]

Theoretically, the increased use of technology should make the instructor more efficient. More should be done with less effort. One logical question emerges: What is to be done with the time that is saved? One very positive possibility is to make it available as needed to the trainees individually. This strategy is certainly appropriate to a distance education program since the trainees are likely to be much more diverse than in the conventional setting. Because of this diversity there may be a greater need for more individualization.[12]

These two settings, the remote classroom receiving live broadcasts and the student at home using self-instruction materials, represent two extremes in distance education. There are numerous other possibilities that become apparent.

It is evident, that the role of the teacher in distance education must be redefined in comparison with the traditional concept.

The same kinds of things happen in distance education as in conventional learning. Information, knowledge, and skills are taught to students. Traditionally, one individual, the teacher, has been the major agent to oversee this process. In distance education the process may be mediated through self-instruction materials, audio or video tapes, computer programs, satellite links or other technological devices. It is important, however, to note that these media are not the teachers or instructors. The student is not being taught by machines. The student is simply accessing what is being learned in a less conventional fashion. The individual or team that produces the material and those who participate in its delivery are filling the role formerly occupied by the conventional teacher.[13]

It is also important that teachers develop a fuller understanding of the pedagogical capabilities of technology. This factor is important for at least two reasons. As teachers utilize more and more technology in the classroom they need to know what can and cannot be accomplished through the various media. Further, teachers are going to be increasingly involved in the teams which produce technologically mediated instructional packages. Thus, they will need to be aware of the potentials and limitations of technology.[14]

The Student in Distance Education. The following are some important characteristics which describe most distance education students:

-Adult (between 20 and 40),
-Highly motivated, and
-Life-long learners.[15]

The simple fact that most distance education students are adults would have been considered a liability in the early part of this century. At that time it was thought that the ability to learn began to decline significantly after age twenty. In 1928, E.L. Thorndike reported results of his research which indicated that in fact the decline in ability to learn after age twenty is much slower and much less acute than was previously thought.[16] He proposed age forty-five as the point where a more serious decline in learning ability begins. In fact, research since that time indicates that significant learning can continue into the seventies or eighties or even longer if an individual is reasonably healthy.[17]

Further, there are important assets that adult students bring to a learning task that children and adolescents generally lack. Since adults have more experiences they have more to contribute to the learning process. In addition, their breadth of experience allows them to relate to more new experiences.[18]

Another positive characteristic of adult learners is that because of their maturity, they can assume a higher degree of responsibility and independence in the educational process. One example of this is seen in what is called the "industrialized counselling" program of the Fernuniversitat, a distance education university in West Germany. As students begin they are offered a preliminary course titled "How to Study." The first assignment includes an extensive questionnaire about the students' life situation, study habits, and motivation. This information is used to compose a computer-generated letter of response which is unique to the student. While this kind of system could be perceived as cold and impersonal, nearly ninety percent of the students have responded positively to it. It is just as effective for them to get this information in a letter as it would be in a personal interview. It should be emphasized that the letters are not form letters but are designed so that ninety-six percent are individualized.[19]

The "industrialized approach" to various aspects of distance education is a feature that is easily misunderstood. The purpose of technology is not to isolate the student. Rather, it contributes to student autonomy and frees instructional personnel to dedicate themselves to other tasks which can include more personal attention as needed.

A high degree of motivation among any group of students is something that is of interest to every educator. Most distance education students must maintain this high degree of motivation in order to carry on a part-time study schedule, frequently in conjunction with full-time employment and possibly family responsibilities.

Further evidence of the higher level of motivation comes from a study conducted among students of the Open University(*) of Great Britain. Among other things, the students were found to be highly goal-oriented, so that "about 75 per cent declared that they studied in order to qualify for promotion."[20]

The view that learning is a life-long task is an ideal that most teachers want to inspire in their students at any level. Most distance education students are characterized by this value, almost without realizing it. An individual who returns to the classroom as an adult is saying, for whatever reason, that the education he/she received earlier is no longer adequate. Some adult students are motivated by financial considerations to make themselves more marketable in a changing work environment. Others may desire to broaden their knowledge as a means of self-improvement. But whether or not they realize it, they are affirming that deliberate, organized learning is not to be limited to the traditional high school and college periods in one's life.

Another point in favor of distance education for adult learners is that many adult students actually prefer the independence and autonomy of a distance education setting to the conventional classroom. Some adults may simply feel uncomfortable in a conventional environment with younger students. There are also some adult students who see classroom instruction as "a closed system that is heavily dominated by individual instructors' points of view and styles of instruction."[21]

The Tutor in Distance Education. One of the traditional complaints about distance education already mentioned is the fear that it dehumanizes the individual because it eliminates personal contact between teacher and student. One element that is present in many distance education programs that helps counter this criticism is the tutor.

A tutor (sometimes called a "facilitator" or "animateur") in a distance education program is assigned to supervise a certain number of students and may be available to them at the learning site, by telephone, or other medium. The responsibility of the tutor can range from administrative tasks such as registration, communicating information, and grading exams to more personal involvement. Some tutors even have basic preparation in the subject matter being taught and can become more directly involved in the learning process.

In addition to administrative and technical support, tutors can also offer encouragement and deal with special needs of individual students. This type of contact can be very important in a distance education program, especially with students for whom face-to-face contact is more important.

There is some interesting evidence, however, on the other side of the issue of face-to-face contact. Common wisdom dictates that such personal interchange is virtually an indispensable element in teaching. Despite this popular idea, research has shown that, in some areas of study, students do as well with little or no face-to-face contact.[22] One likely reason for this phenomenon is that many distance education learners prefer this type of setting specifically because of its isolation. In one study, "more than a third of the respondents stated that they preferred studying on their own to studying in a class with other people."[23] Nevertheless, the tutor can be an important asset to the distance education setting when more personal contact is desired.

HARDWARE

As would be expected the media used for distance education over the years has followed the available technology. Obviously, since the earliest forms of distance education were correspondence courses the main medium was print. Printed materials were sent by mail as were exams and communications between teachers and students. In the developing nations print is still the most widely used medium mainly because economic limitations prevent the use of more sophisticated technology.[24]

Audio Cassette Player. The audio cassette player was quickly appropriated for distance education after its advent. It is currently the most widely used medium after printed materials in the developing nations.[25]

Radio. Radio broadcasting began to be used when that technology became available. The precursor of the Open University in Great Britain was the "University of the Air." Printed materials were available to go along with the broadcasts. While still widely used, there is a definite trend away from the use of radio as a variety of audio visual systems, centered on television, become more readily available.[26]

Television. Predictably, as television has become more common, it too has been more widely utilized for distance education. One hindrance to the growth of television for distance education has been the limitation of broadcast time that was optimal for the students involved. This problem is becoming less important with the growth of cable, fiber optics, and satellite links and with more available channels.[27] Additionally, with the affordability and accessability of the Video Cassette Recorder (VCR), the use and utility of television in the classroom has increased.

Telephone. The telephone has also been widely used in distance education. For some in remote areas it has been the only viable option for two-way communication. Both teleconferencing to small study groups and individual contact between teachers or tutors and students has been done effectively.[28]

A telephone-related technology called "viewdata" has also been used. This system uses the telephone line and appropriate adaptive hardware to display information from a central location on the student's own television screen. It has been possible with this type of system to make a wide range of information available to students and to allow them to ask questions.[29]

Personal Computer. The increasing use of the personal computer (PC) in combination with telephone lines is a more sophisticated type of "viewdata" approach. By means of a modem(*) the PC can be linked, through telephone lines, to a wide range of services. Some of these are simply sources of information that provide

news, access to reference materials and even "electronic subscriptions" to publications. A possibility that applies more directly to distance education, however, is the electronic mail(*) function which allows for one PC to communicate with another. This system allows a student with a PC to access a central location to utilize courseware(*) and ask questions.

Computer conferencing. Computer conferencing(*) is a logical extension of the current use of the networking of PCs as just described. One system used for corporate training is called teletraining. The basic hardware consists of a PC at the central location linked with PCs at the remote locations via phone lines, cable or satellite link. The instructor at the central location can send information which will appear on the monitors of the PCs at the remote locations. The video input can be supplemented with the use of one or more auxiliary TV monitors. The instructor can project graphics onto these monitors and write or sketch on them from a central location by means of an electronic stylus.

The audio element of the conversation is facilitated by use of microphones at each of the remote centers. These microphones, when placed in the center of a table around which a group of students sit, can pick up the voice of anyone in the room who is facing it. Interestingly, much of the training using this system is carried out effectively without a live video image. Since the instructor has such a flexible selection of audio-visual equipment a live image is not usually needed. This feature allows for considerable savings since moving images are much more expensive to transmit than still images.

Interactive Video. Interactive Video(*) allows a student to receive video taped instruction and then immediately practice what has been learned by being presented with a hypothetical situation and two or more choices. Each choice shows a different result. Frequently the results are presented in the form of scenarios that show what might really happen if that choice were made in real life. Usually the video material is recorded on a video laser disk (videodisc(*)) and accessed through a personal computer using appropriate software. While well-designed interactive video courseware is expensive to produce, it is highly effective because of the possibility of simulating real life situations more closely and because of the high degree of student participation.

Satellite. Satellite networks are being used more and more in distance education. Among the clients using training transmitted by satellite are large corporations, universities, and public schools. Satellite broadcasting offers the great advantage of the live visual image. The National Technological University(*) specializes in training for science and industry. Organizations like Ti-In(*) offer satellite classes to public schools. Since satellite courses are transmitted live they can be coupled with

telephone equipment to allow for interaction between students and instructor.[30] When scheduling live transmissions becomes a problem, class sessions can be recorded on video tape and replayed when needed. Although live interaction is not possible with such recorded instruction, students can be given the opportunity to call their instructors to ask questions after the class is viewed.[31] While the instant interaction would be somewhat more advantageous pedagogically, the possibility for delayed questions is certainly a significant advance over simply viewing a videotaped lecture.

Satellite transmitted programs may be purchased on a subscription basis or produced in-house by the institutions using them. Obviously, production capability on a given campus translates into ongoing savings but requires a high initial investment.[32]

Fiber Optics. Fiber Optics is a recent technological breakthrough which promises to play an increasingly important part in distance education delivery systems. It uses glass cable to carry light transmissions. One of its primary advantages is that it can carry a high volume of various kinds of signals using digital transmission. Hence it is possible to carry voice, data, and video images simultaneously. The main disadvantage is the initial cost. However, in a system where a future expansion is anticipated it can be highly cost-effective when amortized over time.

The coupling of distance hardware with fiber optics makes for a system with high flexibility. For example, on a campus with a fiber optics phone system, a video broadcast can originate from any room with a telephone jack.

SOFTWARE

The technological capacity to communicate across distance is a kind of empty shell into which educators pour the content. The shell determines, to a significant degree, what kind of content can be poured in. For example, during the days when correspondence was the only medium for distance education, it would have been impossible to teach some aspects of a subject like music at a distance. Even so, as simple an advance as the audio cassette player increased greatly the possibilities of the kinds of things that could be taught.

In addition, technological advances make it possible to teach more effectively some of the same things that were taught by print. For example, if a student is working with an interactive medium, either interactive video, an interactive courseware program, or a live broadcast, the student is able to get some kind of immediate feedback to reinforce what he/she is learning.

When printed materials sent by mail were the only medium, the answer to a question or the results of an exam, would not be available to him/her for several weeks.

One successful example of increased effectiveness using hi-tech media is the IVIS system used by Digital Equipment Corporation for the training of its employees. The system analyzes how the students learn and provides each student with text, voice, graphics, and audio elements in a configuration uniquely adapted to that student. As a result, "the IVIS-trained students learn up to 53 percent faster and with better retention than students taught by conventional methods".[33]

But such successful use of media in distance education does not occur automatically with the use of advanced technology. The subject matter must be presented in an educationally sound manner. Furthermore, to be most effective it must take into account the media being utilized and the target audience. The crucial element for any educational material, whether printed on paper or mediated through state-of-the-art communications technology is instructional design. If the content is not well presented, high-tech media in itself will not bring about effective learning. Content presentation must take into account the capabilities of the technologies being used. Otherwise high-tech media have no more effectiveness than conventional teaching.[34]

A key issue which faces planners of curriculum for distance education is the tension between what can be called "hardware driven" decisions and decisions based on desired instructional outcomes. In other words, when the use of a certain medium is being considered, the initial question should not be, "What can this media accomplish?" but rather, "What are the instructional goals and objectives which are to be accomplished?" Granted, the former question is important and must eventually be considered, however, it should not be the primary question to be addressed. An example of one type of hardware driven decision which should be avoided is seen in the pressure to use something like teleconferencing simply as a response to the need to deliver more information more rapidly.

> Just because teleconferencing is able to deliver interactive educational programming over great distances does not necessarily mean that teleconferencing is generically suitable for the delivery of all instruction, nor does it mean that all programs of instruction should be candidates for long distance delivery through teleconferencing.[35]

An example of how this tension between hardware-driven and outcomes-driven approaches can be seen in the design of feedback for distance instruction. Feedback in this context refers to the

response that students receive from their practice tasks and assignments. The tendency in designing feedback for distance delivery systems is to first ask the question, "What kind of feedback can this particular system handle?" This approach allows the constraints of hardware rather than optimum instructional methods to become a primary determinant of feedback design. Further, a kind of tunnel vision results which can limit thinking about new developments.[36] Once these decisions about the most appropriate kinds of feedback have been made, the decisions about hardware and other contextual constraints can be considered.

Besides issues involved around instructional design, it is also important to consider whether the subject matter being presented is appropriate for the media involved. Some types of content are not necessarily delivered more effectively through high-tech media. An illustration of this problem comes from a study comparing students who took a televised course in accounting with those who simply used printed texts and guides on their own. There was no significant difference in the examination grades of the two groups.[37]

II. HISTORICAL DEVELOPMENT AND APPLICATION

ANCIENT HISTORY

There is a sense in which distance education has been a possibility ever since man has been able to communicate farther than the human voice could reach.

The Native American smoke signal technology held out the possibility of sending and receiving information. Two individuals communicating with each other over several miles with drums were utilizing an interactive medium to transfer important information across a distance.

Throughout the early years of the Christian Church the leaders kept in contact with the congregations throughout the Roman Empire using hand carried letters or epistles. Frequently a leader would hear of a problem at some distant location, dispatch a letter via personal messenger and receive a reply when the messenger would return. If another letter was needed the cycle would be repeated. Thus the two-way communication over a distance would be maintained.

EARLY U.S. HISTORY

In March of 1728 the Boston Globe ran an advertisement for shorthand lessons available by correspondence. The potential student was assured that:

> any persons in the country desirous to learn this art, may by having the several lessons sent weekly to them, be as perfectly instructed as those that live in Boston.[38]

This is the earliest evidence of distance education in America.

Correspondence study was formally recognized in 1882 when the State of New York authorized the Chautaqua Institute to award degrees through its home study(*) program. Since 1900 the annual enrollment in correspondence courses has grown from a few hundred to over four million.[39]

MODERN HISTORY

Distance education in modern times began with elementary school programs. One of the first of these was begun by the Calvert School of Baltimore, Md. in 1905. The target audience for the Calvert program was children who were unable to attend conventional schools because of illness, isolation or other problems. About that time, similar programs were initiated by the provincial and state governments of Canada, Australia and New Zealand. The need for such programs in these countries is evident because of the large sparsely populated areas.[40]

The Soviet Union began to use distance education in the 1930s to train technicians for its growing industries. It was among the first countries to establish a distance university.[41]

The Open University of Great Britain is one of the most important distance education institutions in the world. It was started in 1969 mainly to help adults who had not been able to complete their secondary training. It now offers both degree programs and continuing education. There are courses available in both vocational and academic areas. One reason for its success is the high quality of its course materials. Most courses are put together by teams of up to seven people composed of subject matter experts and educational technologists. The Open University has become an example and an inspiration for other university level distance educations programs throughout the world.[42]

During the last thirty years, distance education has become increasingly important in the Third World. Better education is seen in these countries as one of the key factors in raising the living standard. Because distance education programs are cost effective, they are one of the best available means for meeting the Third World's burgeoning demands.[43]

Some distance education programs in Central America have been offering vocational and commercial courses for fifty years.[44] India's distance education programs have grown dramatically since independence in 1947. Areas of concentration include teacher training, business administration and industrial training. In Africa, distance education subjects range from basic "Three R's" programs to health care, political issues and environment.[45]

III. PROBLEMS AND PROMISES

Until recent years the term "distance education" was virtually a synonym for "correspondence courses." It was seen by many educators as simply a more or less satisfactory alternative when traditional teaching was not available. As distance education has developed over the years, however, there has been a growing sense among many educators that for some purposes distance education can be just as effective as conventional approaches. In some cases it may be even more effective.[46]

It is important to add at this point that a question such as "Which is best, distance or conventional approaches?" is not really relevant. There is no suggestion here that one approach is superior. Rather the idea is to explore the new possibilities that distance education offers while recognizing, as with any method, some of the difficulties involved.[47] Few, if any advocates of distance education envision that it will replace conventional learning.

ADVANTAGES OF DISTANCE EDUCATION

A key word that sums up many of the advantages of distance education is flexibility.

Flexibility in relation to students. Flexibility in relation to students relates to concerns of scheduling and geography. Courses are offered at times when those with full-time employment can take them. Some distance education programs offer live classes over satellite links at all hours. If subject matter is recorded either in the form of courseware or simply presented in a video taped class it can be accessed at any hour from numerous locations. Easier access is not the only issue involved. For some students distance education programs are the only ones that are available.

Students also benefit from what one expert calls "immediate interface with employment." Some successful distance education programs have been provided by employers at the place of employment for the improvement of job-related skills. Such programs have the double advantage of making opportunities available that might otherwise be out of reach and providing teaching for which immediate reinforcement takes place as the employee practices newly acquired skills on the job.[48]

Flexibility in relation to faculty. Flexibility in relation to faculty is another important advantage. High quality teachers are always in demand. Through distance delivery systems, the potential number of students which a teacher can reach is expanded dramatically. For example, a recognized expert in a field of study teaching at a central location and broadcasting to several remote sites can reach many students who may not able to come to the central location.

An extension of this more efficient use of a teacher's resources is realized when some permanent audio-video copy of the instruction is made. Such a recording can range in complexity from a simple broadcast to inclusion of teaching segments and insights in an interactive video or courseware program.

Built-in quality control. A third advantage of distance education is a built-in quality control that comes from the public nature of the instruction involved. Instruction in a conventional classroom is, in some sense, more private and less permanent. After a lecture is given, it only exists in the mind and notes of the instructor and students. This is true despite all the pedagogical merit and intellectual brilliance that might have been exhibited by the lecturer. Distance instruction, however, is by its very nature more permanent. It is usually preserved in some form whether printed, electronic, audio, or video. For good or for ill, a product that is subject to such widespread public exposure is very likely to be more carefully prepared. In addition, anyone who prepares distance education material is forced to put more thought into how it will be presented.[49]

Easily evaluated and revised. There is another positive characteristic that is related to the permanent existence of materials. Since the materials are preserved in some form, they can be more easily evaluated and revised. Thus, there is an opportunity for "cumulative improvement in pedagogic quality."[50]

Separation of student and teacher. An additional advantage of distance education is seen in one of the very features that makes it seem so alien to some, namely, the separation of student and teacher. Though there are some negative aspects to this separation, one positive aspect is that it helps "students approach more closely the ideal of the autonomous learner."[51]

Lower cost per student. A final and universally acknowledged advantage of distance learning is the lower cost per student. While there is little argument against this advantage per se, there are issues that make this point more complex than is immediately apparent. Financial issues will be discussed in more detail in the section on "Costs and Benefits."

DISADVANTAGES OF DISTANCE EDUCATION

Normally a new way of doing things takes some time to gain acceptance. The initial resistance to an innovation functions as a clearing house to filter out some of the unworkable ideas and force those that are feasible to become more clearly defined. Distance education is continually becoming more widely accepted. Nevertheless, it is still in the innovation stage and thus meets resistance from those who do not yet fully understand it.

Jason Ohler, of the University of Alaska at Juneau, compares current growth in distance education to the introduction of the first steam engines into factories 200 years ago. There were few people at that time who could foresee the far reaching effects of that invention on the economy and culture of the world. Distance education, according to Ohler, has the potential for similar far reaching ramifications in the realm of education.[52]

This optimism notwithstanding, distance education is still going through the process of overcoming the inevitable inertia which any innovation faces after its introduction. At the same time it is being exposed to a continual process of "exploration and interpretation of alternative futures."[53] The process should be a permanent feature of education in general if it is to adapt to changing needs and be a viable option for the preparation of students. Consequently, there are certain problems that must be considered if a complete picture of distance education is to be presented.

There are a number of pedagogical problems which come to the fore when distance education is discussed. Several of these, such as two-way communication between teacher and student, and adaptation of traditional material for distance delivery have already been mentioned. One issue, however, which many will perceive as a problem is that of interaction between the students themselves. Since there is such a variety of possibilities for distance education settings it is impossible within the scope of this monograph to deal with all of them. But there are some general insights which can be helpful.

Even with the most extreme example of distance education, the isolated correspondence student, there are possibilities for interaction with other students. One method which has been successfully utilized is the study circle where distance education students who are reasonably close to each other may get together periodically to talk about what they are studying. Study circles have been used to great advantage in sparsely populated areas of Finland. University-level courses are studied by groups of three to ten students who work independently but

come together periodically, for seminars, lectures and consultation with supervising professors.[54]

In settings where more advanced technology is being used the same systems that allow for two-way communication between teacher and students can also be extended, if necessary, to provide for more interaction between the students involved at various sites.

Some of the problems relating to distance education are psychological and administrative rather than pedagogical and technological. The very fact that a course is produced in one place and used in another will cause some difficulties. Such difficulties can range from something minor, like scheduling conflicts for live broadcast to major issues, like cultural differences.

One example of a major administrative issue is teacher certification. Since certification is controlled by the states, problems could emerge when distance education crosses state boundaries. Most certification regulations were made when such possibilities did not exist.[55] At first glance this limitation would seem to apply mainly to primary and secondary education. An example of a similar concern in professional training, however, comes from engineering. Since engineering is a profession with rigorous standards, there are potential conflicts when the requirements of one state may not line up exactly with those of another.[56]

The complications surrounding certification have taken institutions by surprise. This is true partly because distance education has increased so rapidly in recent years. Some time has been bought through provisional agreements between states. Such tentative arrangements, however, must eventually be replaced by more permanent long-term solutions.[57]

Another kind of difficulty may occur when students in one state take advantage of a distance education program in another and thus deprive conventional institutions in their home state of students. Both this problem and that of certification have even more far reaching implications as the possibilities for international distance education programs become more widespread.[58]

An issue which relates to both administrative and psychological factors is the perceived threat of distance education to the teaching profession as it is understood today. Understandably, there are teachers who, upon their initial exposure to the idea of distance education see themselves in danger of being replaced by technology. In fact, one of the main advantages of distance education is not that it eliminates teachers but rather extends their reach and efficiency. In numerous situations, a distance program allows students to be taught more specialized subjects

that would not otherwise be available to them.[59] It is likely that some teachers' roles will change with the increased use of distance education. As has already been mentioned, the teacher becomes more a facilitator and coach than simply a dispenser of knowledge. Some who are now teaching may eventually become more involved in course development. But rather than eliminating teachers, distance education takes fuller advantage of the abilities of teachers especially those who are outstanding.[60] Including teachers in the earliest planning stages of distance programs is one way to minimize the perceived threat. In addition to gaining valuable insight, such inclusion allows teachers to see the advantages of distance education so that, in many cases, they actually become advocates of the idea.[61]

These kinds of problems are certainly not insurmountable but they must be worked out as distance education becomes more widely used.

A possible source of friction growing out of the increased use of distance education is cultural diversity. There are a number of disadvantaged indigenous groups, for example, for whom distance education can be quite advantageous. It offers them an alternative that is both geographically and economically viable. Nevertheless, there exists the threat in such a situation that the more sophisticated society which produces such programs will displace those who receive it. One possible solution to this problem could provide "'raw' course work which allows on-site coordinators to fill in 'blank areas' with examples and metaphors of local significance."[62]

Another possible pitfall to be avoided where distance education is concerned relates to the promotion of technology by its manufacturers. Those in decision-making positions need to develop a healthy skepticism with regard to the advertising claims of commercial producers of both hardware and software. The mere fact that something can be done with new technology does not mean that it is educationally sound or cost effective. Each product needs to be evaluated on its own merit in terms of instructional design.[63]

IV. POTENTIAL VALUES FOR VOCATIONAL EDUCATION

DOMAINS OF LEARNING

Some of the characteristics of vocational education will require special adaptation of distance education systems. One way of approaching this problem is to consider the various domains of learning and decide how these interface with vocational education. There are a number of different approaches to the issue of learning domains. The following list is an adaptation of one taxonomy(*) of learning.

-COGNITIVE DOMAIN: related to the acquisition of intellectual knowledge.

-PSYCHO-MOTOR DOMAIN: related to skills that require hand-eye coordination.

-AFFECTIVE DOMAIN: related to emotions and attitudes.

In the cognitive area distance education is "at least as effective as any other form of teaching and learning."

Some psycho-motor skills can be taught well through distance education and some cannot.

The affective domain presents special problems in any educational setting, conventional or distance. Emotions and attitudes, while extremely important are very difficult to measure and predict. It is not always clear whether the learning environment or the student's own make-up or other unknown factors are the main sources of attitudes toward development. It is relevant to note the relationship of the affective domain to what has already been said about the adult learners in distance education. Adults who involve themselves in distance learning will, as a rule, already have a positive attitude toward learning because they will have overcome significant obstacles in order to be there. Well-designed materials and a well-run program will go a long way toward maintaining and taking advantage of this positive attitude.

It is also possible that distance education helps teachers see how students will act/react in potentially emotional situations or situations in which a student's "affect" is untested. For example, using interactive video in a health occupations program,

one that simulates an emergency or life-threatening situation, teaches students about making snap decisions while keeping their emotions in check.

The most significant area of discrepancy is the psycho-motor domain. Some aspects of vocational courses are more likely to require the student to be physically present with the teacher. A format which involves a combination of distance education and first hand practice requiring the student's presence at some central location may be indicated. Even with this arrangement there would be considerably less student travel than with a wholly conventional approach.

Another important point is that there are incidents of successful teaching of psycho-motor skills in a distance education setting when the student uses some type of lab kit in connection with well-designed distance instruction.[64] Another alternative which has been used with success is mobile units which allow a limited amount of equipment and resources to be moved around.[65]

Advances in computer simulations also hold the promise for a wider range of effective instruction in the psycho-motor domain. Flight simulators have been used by airlines and the military for years to train pilots. Because of recent advances in computer generated graphics, the realism of these devices has been greatly enhanced. For example, the FAA now certifies commercial co-pilots to move up to passenger-carrying pilots on the basis of simulation testing and training.[66] Simulators of heavy trucks have been developed in West Germany. These devices give the "driver" sitting in a mock-up truck cab the sensation of moving on the road and encountering various conditions and obstacles. At present they are used for testing but such devices could be used for teaching as well.[67]

While such sophisticated devices as flight simulators would not be appropriate for most state-level distance education programs, one can envision advances in simulation devices which could be used to teach a variety of psycho-motor skills.

EXAMPLES

The following examples were chosen to illustrate the variety of possibilities for distance education. Some of them relate specifically to vocational education while others contain elements which could easily be applied to many areas of vocational training.

In Queensland, Australia, a distance education approach has been used successfully to bring power station control technicians up

to date on rapidly changing technology. The project team assigned to deal with the problem devised a solution with an effective combination of low-tech and high-tech elements. Printed, self-paced modules were made available to the technicians. A computer terminal was installed at each power station to provide testing on demand to the trainees. Because of "the combined engineering/educational backgrounds of the project team, [there was] a considerable cost savings in hardware and time spent in instructional design while continuing to support personal and individualized learning styles."[68]

In Colorado Springs, Colorado, a local school district with help from a nearby university produced an interactive video to teach employability skills. The need for such a package was brought to the attention of the school district's Vocational Education Advisory Council as a result of a national study that indicated that most people (85%) "who are fired from their jobs are not fired because of deficient technical skills but for behavioral reasons." The problem was especially acute in the area served by the school because of the wide variety of ethnic and economic backgrounds of the students. The interactive video presented a number of work situations that an employee might encounter. When a point was reached at which a relevant decision needed to be made, the student was asked to select from several choices. Immediately the results of the student's choice were presented to the student. Finally, a computer-generated test was administered with immediate feedback. This package titled, "Attributes for Successful Employment," is one of the first produced by a local school district. It won the Silver Star Award at the 1988 Houston Film festival and has been acclaimed in the Education Journal.[69]

Some public schools in remote areas of Oregon are using a program called Ti-In. The Ti-In program originates in San Antonio, Texas. Classes are given via interactive television. The teacher sits in front of a camera and uses visual aids to illustrate teaching points. Each student is equipped with a remote telephone that can br used in asking questions. As an added personal touch the teacher in Texas has snapshots of each of the students so that she can see who is asking the questions. The advantage of this program for the setting in Oregon is that it allows a wide range of electives to be offered in small schools that would be unable to hire certified teachers for the same courses.

One combination distance-conventional program which has come to terms with the difficulty of providing hands-on experience in vocational courses is in the Northeast Wisconsin Technical Institute in Green Bay. A two-credit television course is offered on the theory of AC-DC circuits. The course is taken by students at home. A two-credit lab session is offered to give the students needed hands-on instruction. The lab is offered

both during regular school hours and on Saturdays. Teacher contact is available at an initial orientation session and review sessions before exams as well as by telephone and mail. Two important factors which have helped to ensure the success of this particular program are a well-qualified instructor and well-designed materials.[78]

V. COSTS AND BENEFITS

One apt analogy used to compare distance education with conventional education states that while "conventional education is financed by 'installment' buying . . . . distance education is partly bought on the 'layaway plan'."[71] If distance education is done in a high-tech environment, it will be necessary to make a significant front-end investment. In a well thoughtout and well run program, however, the cost per student will almost certainly be lower when averaged out over a longer period of time. In addition, students will have been reached that may otherwise have missed the benefits of the training offered.

The main reasons for the high initial cost relate both to technology and materials (hardware and software). If state-of-the-art technology is used (computers, videodiscs, satellite links, and others) it is obvious that a substantial up-front investment will be required. Regarding materials, the textbooks, workbooks, and other resources used in conventional education are virtually never satisfactory in a distance setting. The production of well-designed materials, using print, computer software and other media, is expensive. Scrimping at this point, however, is counter productive since poor materials are directly related to poor enrollment and thus to lowered cost effectiveness.[72]

One example of the kind of front-end investment that is required in the design of high-tech courseware can be seen in the production of an interactive video package. In the summer of 1985 a joint venture between the University of Notre Dame and the South Bend Community School Corporation was begun to produce a pilot interactive video package for use at the secondary level. A team composed of educational technologists from the university and secondary science teachers from the school corporation worked on the project during the summers of 1985 and 1986 with some time given to it during the 85-86 academic year with positive results.[73] Obviously, the length of time involved will seem excessive. It should be noted in this case that the teachers had to go through some preparatory training to become more aware of the capabilities of technology and the design processes involved. However, if such a program can be widely used over a period of time, it will more than pay for itself in the time it saves teachers to devote to other tasks.

Some general guidelines for cost effectiveness are well summarized in the following statement by David Giltrow who has wide experience in distance education:

> The cost per student can be favorable in distance education when enrollments are high, the course is used over several semesters, or where low enrollments cannot support a conventionally taught course at individual institutions but combined totals justify distance education.[74]

As an example of how some of the guidelines work, Giltrow gives a hypothetical example of a telecourse(*) that costs $300,000 to produce. If 3,000 students are enrolled in this course during the first year the cost is $100 per student. If, however, the course is repeated five times with 2,000 students enrolled each time the cost drops dramatically to about $23 per student.[75]

Giltrow also offers a number of other practical suggestions for lowering cost. If an institution belongs to a production consortium, quality materials can be produced more economically. Creative use of existing resources can also save money. Finally, contracting for services instead of hiring permanent staff can also reduce costs.[76]

Another important consideration relating to the cost of distance education is the fact that costing of distance education is radically different from that of conventional programs.[77] The formulae which are used to allocate funds for conventional teaching do not apply to distance education. The initial preparation time for a distance education course may be longer than for a conventional course. But if the course has an extended "shelf life" during which it can be reused, then the annualized cost will obviously be reduced. Face-to-face contact hours which are sometimes used to figure costs are virtually meaningless in a distance education setting. In addition, distance education programs usually require extra clerical staff and have higher printing costs than conventional programs. Obviously, these and other factors must be taken into consideration to form an accurate financial profile of distance education.[78]

An additional consideration which helps with the lowering of overall costs over a period of time is the relative ease with which many distance education programs can be revised. Once the materials are in some kind of permanent form, even though updating is needed, it can be done at a fraction of the original production costs.

The following list represents a hierarchy of least expensive to most expensive startup costs for various media approaches.

1. Correspondence courses (print only)
2. Remote classrooms using teleconferencing links
3. Telecourses (leased/adapted)
4. Correspondence courses using media/computers
5. Telecourses (locally produced).[79]

VI. TRAINING NEEDS OF TEACHERS

Continuing education is a reality in almost every area of modern life. As distance education becomes more widely used, those involved in preparation and delivery of programs will need to learn more about the unique requirements of distance education settings. It is important, however, to note that "there are certain general rules for learning and...for teaching. It is true the applications of these rules might vary but there are no unique principles inherent in distance education which are not also inherent in mainstream education."[88] A capable and qualified teacher who becomes dedicated to distance education, possesses a wealth of experience and expertise for which further orientation in distance education methods is a needed refinement.

It is evident that teachers becoming involved in distance education must concentrate on understanding the pedagogical capabilities of technology. An important issue at this point has to do not only with what can be done with a certain medium, but also, how the medium can be used to the best instructional advantage. For example, simply taking the contents of a textbook and putting them into a computer so that the computer is merely an "electronic page turner" has little, if any, additional advantage to justify the expense of the time and the hardware involved. On the other hand, the material from the same textbook can be incorporated an interactive medium. This would allow the student "dialog" with it and thereby increase its instructional value considerably. Certainly exposure to the developing theories which apply to distance education is helpful at this point. Even so, a qualified teacher with a background in conventional settings is going to have the basic skills required to become involved in distance education.

An important element in the preparation of persons undertaking distance education is simply an overall understanding of what distance education is about. As has been mentioned there are important differences between the role of the conventional teacher, and that of one involved in distance education. For example, the teacher serves more as facilitator, coach and guide than as simply a dispenser of knowledge.

One distance education institution that provides a helpful example at this point is Athabasca University in Canada. Since all its classes are delivered over distance, the situation is somewhat different than a institution where both conventional and distance education go on.

The following list illustrates the differences between an institute in which both conventional and distance education curricula are taught, and Athabasca, which uses only distance education curricula:

-There are no students on campus

-Teaching is only one of several of a professor's activities

-There is less autonomy

-Lines between 'academic', 'support', and 'service' divisions are less clear

-The product of course preparation is available for all to review and judge

-It is usually the tutors in remote locations that have direct student contact

-Students are allowed to enroll on the first of every month so there is no traditional "academic year."

-There may be a tendency to neglect research

-Traditional academics who come in may feel uncomfortable and be perceived as a threat.[81]

It is evident that a few of these differences have possible negative implications. As with any system there are some inherent problems that must be recognized and answered. For example, the tendency to neglect research is more common in the early stages of a developing distance education program since a large amount of time is taken producing material from scratch. In general, however, this problem levels off as time goes on and research is given its proper place as in any reputable university.[82]

In addition to a general orientation to distance education and a familiarity with the technology, one of the best ways to prepare a staff person that is new to a distance education setting is to provide a supportive atmosphere which allows the person to work with experienced course developers to acquire hands-on experience in the preparation of course materials. This approach has proved more beneficial than a formal preparation program.[83]

Further, the frequently encountered misunderstanding that distance education is intended to replace conventional education must be addressed.

Certainly distance education, supported by modern technological advances, offers possibilities that were unheard of even ten years ago. Continued advances in educational technology hold the promise for even more new ideas for the future in all areas of learning and instruction. But the issue is not "either distance or conventional" but rather how can these two approaches best complement each other.

VII. EVALUATION OF DISTANCE EDUCATION PROGRAMS

A number of examples have already been mentioned to illustrate how distance education works in various contexts. The following examples are added because they include some systematic evaluation of distance systems.

TEXAS INTERACTIVE INSTRUCTIONAL NETWORK (TI-IN)

The TI-IN satellite network has already been mentioned in connection with distance education delivery. A survey of a group of TI-IN students was conducted recently following the group's completion of a thirteen week graduate course titled "Models of Teaching."

There was a total of thirty-four students at thirteen different sites. Most were public school teachers. Seven professors were involved in the broadcasts of the classes over a thirteen week period. There was also a "facilitator" at each remote site to set up equipment and see to administrative matters.

Several facts from the results of the survey substantiate some of the points that have been made thus far regarding distance education. All the students were significantly closer to the remote sites where they attended the class sessions than they were to a graduate university where they might have attended a conventional class of the same type.

Slightly more than sixty percent felt that the instruction via television was as interesting as or more interesting than standard classroom teaching. While fifty-six percent said they still preferred classroom teaching to satellite television, almost seventy percent said they would take a similar course again if it were offered. The students were divided almost in half over whether studying in this setting was harder, or about the same or easier. About seventy percent considered the class a meaningful experience and about sixty-five percent affirmed that the professor(s) had made them feel needed and important. While the evidence was not conclusive, the distance education students seemed to perform about as well on assignments, activities, and examinations as those who had studied the same material in a regular classroom.

On the negative side, there were technical problems which made calling in questions more difficult than it should have been and thus lowered the number of student questions to the professors. In addition, there were complaints about the limited possibilities for interaction with students at other sites. There were also some technical problems, mostly weather related that interfered with some of the broadcasts.[84]

INSTRUCTIONAL TELEVISION FIXED SERVICE (ITFS) IN ARIZONA

Arizona State University's Instructional Television Fixed Service televises four channels of classes to remote classrooms throughout metropolitan Phoenix. The broadcasts originate in classrooms so that there is a possibility for the combination of conventional and distance education simultaneously. At the on-campus site, each student desk is equipped with a microphone and remote sites are equipped with telephones. This setup allows both questions to the instructor and discussion among students at all the sites. The remote sites are located in nineteen industrial plants and one branch campus.

In 1986 a survey was conducted of one hundred ninety-four students in the ITFS program. One hundred seven were in engineering classes and 87 were in business classes. The survey item which elicited the most positive response was one which related the reason for enrollment to accessibility of location. The main reason for enrolling for 92 percent was convenience of location. This evidence, as well as expression of intent to take another course at the remote locations clearly indicated that students were being reached who would not otherwise take the courses.

The principle negative results related to discussion with students at other sites and receiving written assignments back on time. As in the report on TI-IN, both these problems can be solved with relative ease by adjustment of the technology involved.

INSTRUCTIONAL TELEVISION

A research review of instructional television was commissioned in 1986 by the Coordinating Board of the Texas College and University System. The review offers significant evidence that this medium is coming into its own after a period of being poorly used. An effort was made in this review to find studies which had been done independent of the "users, producers, and funders" involved in the various programs.[85]

The following conclusions are taken from the executive summary of the report presented to the board:

1. Comparative studies indicate that students taking courses via television achieve in most cases, as well as students taking courses via traditional methods.

2. Findings of equivalent student achievement hold even when rigorous methodological research standards are applied.

3. Television is a technological device for transmitting communication and has no intrinsic effect, for good or ill, on student achievement.

4. Effective instructional design and techniques are the crucial elements in student achievement whether instruction is delivered by television or by traditional means.

5. National producers and funders of telecourses employ rigorous standards and procedures to create academically acceptable products which will withstand the critical scrutiny of scholars.[86]

A significant area where more research about the effectiveness of instructional television could be done is the identification of the unique qualities of this medium which might improve instruction and achievement even more.[87]

INTERACTIVE VIDEO

Some of the advocates of interactive video have made enthusiastic claims about the possibilities related to this relatively new medium. In 1985 a study was carried out in which two groups of students received video instruction in photography. In one group the instruction was given using interactive video (IV). The other group's instruction was by means of a linear video tape (LV) with no interactive features. The material contained in the two presentations was essentially the same.

The IV group "recorded significantly and consistently larger achievement gains than did the LV group" as indicated by a difference in means between pre-test and post-test scores. The difference for the LV group was 29.70 and the difference for the IV group was 35.81.

While this improvement in achievement is important and encouraging, an even more significant result may be the improvement in attitudes of the students. An analysis of the results indicates that students preferred IV to traditional instruction, that they felt they learned more quickly than by traditional methods and that they had positive feelings about the higher level of control which they were able to exercise over the rate and sequence of presentation.[8]

VIII. MODEL PROGRAMS

The following examples are added to those already given throughout the monograph because they illustrate the use of distance education in more widely distributed programs and not just individual courses or media.

THE UNIVERSITY OF WISCONSIN

The University of Wisconsin's Educational Teleconference Network has over 200 remote cites around the state. These cites are located in county courthouses, various campuses of the university, public libraries, and other public institutions. Each remote location is equipped with a high fidelity speaker and microphones which can be activated by the students. This arrangement "permits live interaction and allows for immediate feedback and interaction between teacher and student."

As an example of how this network operates the system has been used effectively since 1973 to teach music. Recently, a program was offered for church musicians. The program concentrates on the artistic aspects of music which can be taught without visual reinforcement. The students receive printed materials beforehand which are coordinated with the audio lessons."

IOWA STATE UNIVERSITY

Iowa State University (ISU) uses satellite technology for educational programs across the state. ISU's capability for this kind of program is greatly enhanced because there is a commercial television station on its campus. The program was initiated in 1985 for co-op extension broadcasts. For the present school year (1988-89) twenty-two non-credit programs and one sixteen lesson agricultural credit course were planned. There are plans to expand this use of the satellite system to deliver educational programs of ISU Extension across the state. Presently 85 of the 100 county extension offices in the state have down link capacity so they can receive the satellite broadcasts.

AT&T

One highly sophisticated corporate distance education environment is the AT&T teletraining network headquartered in Cincinnati.

The system was developed to help meet the company's needs for frequent continuing education updates for employees nationwide. It has proven to be a highly cost effective option when compared with the cost of the frequent travel of employees to some central location."[90] The hardware used is called a "PC (personal computer) teletraining network." The PCs used in the program are linked in a network with television monitors and other hardware capable of transmitting audio-visual signals. The teacher at the broadcasting site has several options in addition to voice transmission including sending pre-prepared graphics and writing with an electronic stylus. Two-way voice communication allows for questions and discussion.

THE UNIVERSITY OF MAINE

In September of this year, the University of Maine in Augusta will inaugurate The Community College of Maine/Telecommunications System. Part of the purpose of this new institution is to use the latest technology and distance education methods to make two year programs available to more students around the state. A total of fifty locations will be linked using a fiber optics system. This particular system will allow a class to originate from any one of several campuses and be broadcast to any of the others. The system will allow for students at the remote sites to interact with their instructors. In addition, syllabi, exams and other material can be distributed to the remote sites by electronic mail. Class schedules are determined by the needs of the students. The classes will be transmitted during the hours when there is the greatest demand."[91]

SUMMARY AND CONCLUSION

DISTANCE LEARNING - GETTING STARTED

In summarizing some of the basic ideas related to distance education, the first priority should be the people involved. The teacher's roles will be modified to that of facilitator or learning coach and will probably include working on a team with educational technologists and others to develop instructional packages. Teachers will continue, nevertheless, to need all the teaching skills on which they may have depended in the past. In fact, participating in distance delivery will probably challenge their expertise as teachers more than ever. As a kind of compensation, the results of their efforts will be reaching more students than before.

The students in distance programs, being mostly adults who are continuing their education, are more diverse than most student populations. They will require more creative approaches than those who participate in traditional instruction. They are also, as a rule, more highly motivated as evidenced by their willingness to add studies to an already full schedule.

With regard to the distance programs and delivery systems themselves, the single most important consideration is instructional design. This principle applies to any instruction from the most conventional to the most innovative. The use of technology can certainly enhance instruction. The very presence of technology, however, offers no guarantees for effective instruction apart from careful design of the instruction itself. A positive factor in the current proliferation of technology is the parallel effort by researchers to discover the most efficient and effective methods for its use.

In relation to use of resources, any consideration of widespread use of distance education should be accompanied by the realization that the high initial investment which will be required for orientation, technology, and production can be more than justified by the eventual increase in efficiency and effectiveness of instruction. This averaging out will occur provided the instruction is well designed and the target population is understood. Most distance education, by its very nature, requires greater effort to produce a given item of instruction. But since that instruction is usually preserved so that it can be "reused" great savings can be realized as more students take advantage of it.

VOCATIONAL EDUCATION - A SETTING FOR INNOVATION

After many years of following in the footsteps of traditional education, there are reasons to believe that vocational education is the most appropriate setting for the application of distance education technology as it exists today. Several states have shown initiative and are using distance education to overcome time, distance, age and socio-economic barriers that often deprive citizens of knowledge and skills needed to prepare them for today's work force.

Vocational education institutions are small in comparison to most other institutions of higher learning and are, therefore, capable of being more flexible and adaptive. There is abundant evidence in all sections of society to indicate that small organizations are more often the source of innovations than large organizations.[92] One reason why small institutions, and especially vocational ones, can be more adaptive and creative is that they allow individuals to have an immediate and significant impact.

Another reason vocational education settings are ideal for distance education is that the technology can be expected to contribute toward a solution to a problem that is somewhat unique to the needs of vocational students. This technology has the capability of delivering complete chunks of information to remote locations in a cost effective way. Australia, Alaska, South Africa, and remote parts of the United States were early pioneers and innovators with uses of telecommunications technology in delivering K-12 and higher education courses as a necessity to compensate when instruction was not feasible at the local level. Now, with the advanced and increased availability of telecommunications equipment, educators are able to reach beyond local classroom settings to provide programs and curriculum to students in all educational settings.

The section dealing with the advantages and disadvantages of distance education was titled "Problems and Promises." When dealing with new technology in education or any other area one of the main problems is the promises. With the proliferation of the so-called "labor saving devices" of the past several decades there were those who predicted a life of leisure for most everyone by the eighties. With the first manned space flights of the sixties came visions of travel around the solar system by the end of the century. The simple fact of the existence of technology, however, does not guarantee that it will be used to its fullest potential nor that it will be used in ways that are most beneficial for society.

In the area of education there have been many false promises. For example, as television became more widespread in the fifties, some educators perceived it as a revolutionary new teaching tool. The initial results were disappointing. In some cases a given educational television program was simply "plugged in" in place of the class lecture. The lower effectiveness of such an approach was due in part to the lack of interaction between the student and the teacher. It is interesting to note that television is now a major element in many effective contemporary distance education systems. The interaction has been added, however. One reason for this early failure of television was that a new technology was being used according to old methods. It was assumed that the in-person class lecture could be replaced with a televised lecture. It took time to work out educationally sound uses for the new medium. It is only recently that instructional television is living down its bad reputation which was gained during the era of "talking-head productions."[93]

Technology offers numerous advantages in education and many other areas. Indiscriminately throwing technology at a problem, however, will not solve it. The application of technology must be carefully thought out, applied, and evaluated if its full potential is to be realized.

A holistic approach to planning is important when working with high-tech delivery systems. Planning should be design driven rather than hardware driven. In other words the kind of media that are used in a given course or curriculum is determined by the content involved and the instructional goals of the course. Obviously, better instructional products result from this approach. In addition, it is easier to establish "a foundation of a generalizable planning strategy [which can be]...more easily adapted as new technologies appear."[94] There is evidence to indicate that widely effective distance education programs are more likely to be realized where organizational structures are modified to take new approaches into account. This does not imply the dismantling of the existing structures. Rather, the goal should be that "the qualitative essentials of [existing institutions]...be extended to reach students not now being served."[95]

APPENDIX

DEFINITION OF TERMS

Note: The following terms are defined in the context of distance education and do not necessarily correspond with other definitions used in a different context. In many cases, standardized definitions have been combined to present a clear understanding of the term as it applies to distance education.

Audio Conferencing-two or more locations linked together with an audio signal via the use of telephones (see also "video conferencing" and "computer conferencing").

Computer-Assisted Instruction (CAI) - Instruction mediated by computer. The most common application is teaching facts and algorithmic processes through structured questions and answers. CAI focuses on student mastery of material. The system allows for remediation based on answers but not for a change in the underlying program structure.[96]

Computer Conferencing-two or more computer locations linked together to share information or data through modems and telephone lines (see also "audio conferencing").

Courseware-a teaching package designed for use with computers which usually contains both software and printed materials designed to accomplish one or more specific learning objectives.

Distance Education-education via the communications media (correspondence, radio, television, and others). Even though there is:

> "little or no classroom or face-to-face contact between teachers and students,"[97] there is the provision for "two-way communication between (among) teacher and student(s) for the purpose of facilitating and supporting the educational process."[98] The characteristic of two-way communication is very important. Otherwise the student is essentially studying independently with no connection to a learning institution.

Distance Seaming-Learning through distance education using systematically created materials, occasional tutor contact, and communications media. Such learning requires efficient time management, motivation, and independent study skills.[99]

Down link-an antenna dish and associated equipment used to receive signals from a communications satellite. Such equipment may be capable of receiving only, or it many be able to send and receive signals (see also "up link").

Electronic mail-the sending and receiving of messages between computers in a network.

Electronic stylus-a device which can be used with two or more computers in a network so that something can be written or drawn at one location and simultaneously transmitted to another.

Fiber Optics-the use of an ultra pure quartz strand as a replacement for copper wires and cables to transmit simultaneous audio, video, and data signals. The fiber allows for laser-generated pulsed light signals to be used rather than electrical pulses.

Hardware-Distance education hardware includes equipment necessary to transmit and receive audio, video, and data signals. Hardware includes television cameras, monitors, video camera recorders, transmitters, receivers, satellites, satellite dishes, interconnecting cables, projectors, computers, and microprocessors.

Home Study-a form of distance education that has traditionally used only print materials with very little or no interaction with an instructor. With the advancement of educational television, home study now may be supplemented with video lectures and demonstrations.

Interactive Television-two or more locations linked together with both cameras, monitors, and audio equipment that allow two-way communication between teacher and students.

Interactive Video-The use of computer technology coupled with recorded video images (usually on a videodisc) to present individualized instruction which requires responses from the learner. Responses result in individualized instantaneous information (feedback) for the learner. Increased student participation and individualized responses are two factors that help enhance learning.

Modem-a device used to interface a computer with telephone lines so that it can communicate with other computers that are similarly equipped.

National Technological University (NTU) - a private, non-profit institution, located in Texas, and founded to serve the advanced educational needs of...engineers, scientists and technical managers.... On a nationwide basis, NTU offers a wide range of instructional television courses taught by the top faculty of 24 of the nation's leading engineering universities.

Open Learning-the use of non-traditional means of achieving educational goals. It is an approach to learning that allows students with as much flexibility, choice and control as possible over content and learning strategies. Open learning courses are usually available to all without entrance or pre-requisite requirements.

The Open University-a distance learning institution founded in Great Britain in 1969 to give broader educational opportunities to adults who have not completed their secondary training. Numerous other distance programs in various parts of the world are patterned after the Open University.

Pacing-the process of establishing assignments, deadlines, schedules and course completion dates for distance learning courses.

Satellite link-see "up-link" and "down-link."

Software-Distance education software includes those materials which usually require hardware to make them usable. Software includes, computer programs, print materials, transparencies, audio and video recordings, slides and film.

Star School Program-enacted by Congress in 1987 and authorized the total spending of $100 million over a five-year period. The purpose is to encourage improved instruction in mathematics, science, foreign languages and other subjects among small or remote schools through the use of satellite and other distance learning technologies. Grants are awarded annually with a three-fold purpose: to develop, construct, and acquire telecommunications, audio and visual facilities and equipment, to develop and acquire instructional programming and to obtain technical assistance for the use of such facilities and instructional programming.

Taxonomy-classification of things or ideas into categories. Originally the term was most commonly associated with the classification of animals and plants into various phyla, species, etc. More recently the term has also been applied to the classification of ideas such as types of learning.

Telecourse-a course presented from one location to another that allows for one-way or two-way visual and audio contact by means of television. The course is usually supplemented with a text or study guide.

TI-IN (Texas Interactive Instructional Network)- A satellite network begun in 1985 for the distance delivery of secondary and postsecondary courses. It is uplinked to the Spacenet II satellite which it uses to broadcast a video signal of the classes. Interactivity is achieved by means of cordless

telephones available to students at the receiving site which can be used to communicate with the instructor to ask questions during the broadcasts. It has been used for distance courses inside and outside the state of Texas. TI-IN broadcasts are being used in more than twenty states.

Tutor-in distance education a tutor is one of several terms used to refer to individuals who oversee a group of distance students. Responsibilities may include administrative details, organization of group study sessions, and help with individual problems. Depending on the configuration of a given distance program, the tutor may be on site at a remote center to talk with students face-to-face or be responsible for keeping in contact by phone with a group in a certain geographic area.

Up link-equipment used to transmit signals to a communication satellite (see also "down link").

Video Conferencing-two or more locations linked together with a video signal via the use of satellite technology or fiber optics. Linkage may allow for one-way, two-way or interactive video with an accompanying audio signal (see also "audio conferencing" and "computer conferencing").

Videodisc-a laser disk used for the recording of video images. Because a videodisc is more easily accessed than a video tape it is frequently used with interactive video hardware and software.

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